# IPC-1756

## Manufacturing Process Data Management

IPC 175X Schema Version 2.0

February 2010

*A standard developed by IPC*

*Association Connecting Electronics Industries*



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- Minimize time to market
- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
- Include a feedback system on use and problems for future improvement

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IPC-1756

# Manufacturing Process Data Management

Developed by the Manufacturing Process Declaration Task Group (2-18a) of the Supplier Declaration Subcommittee (2-18) of IPC

Users of this publication are encouraged to participate in the development of future revisions.

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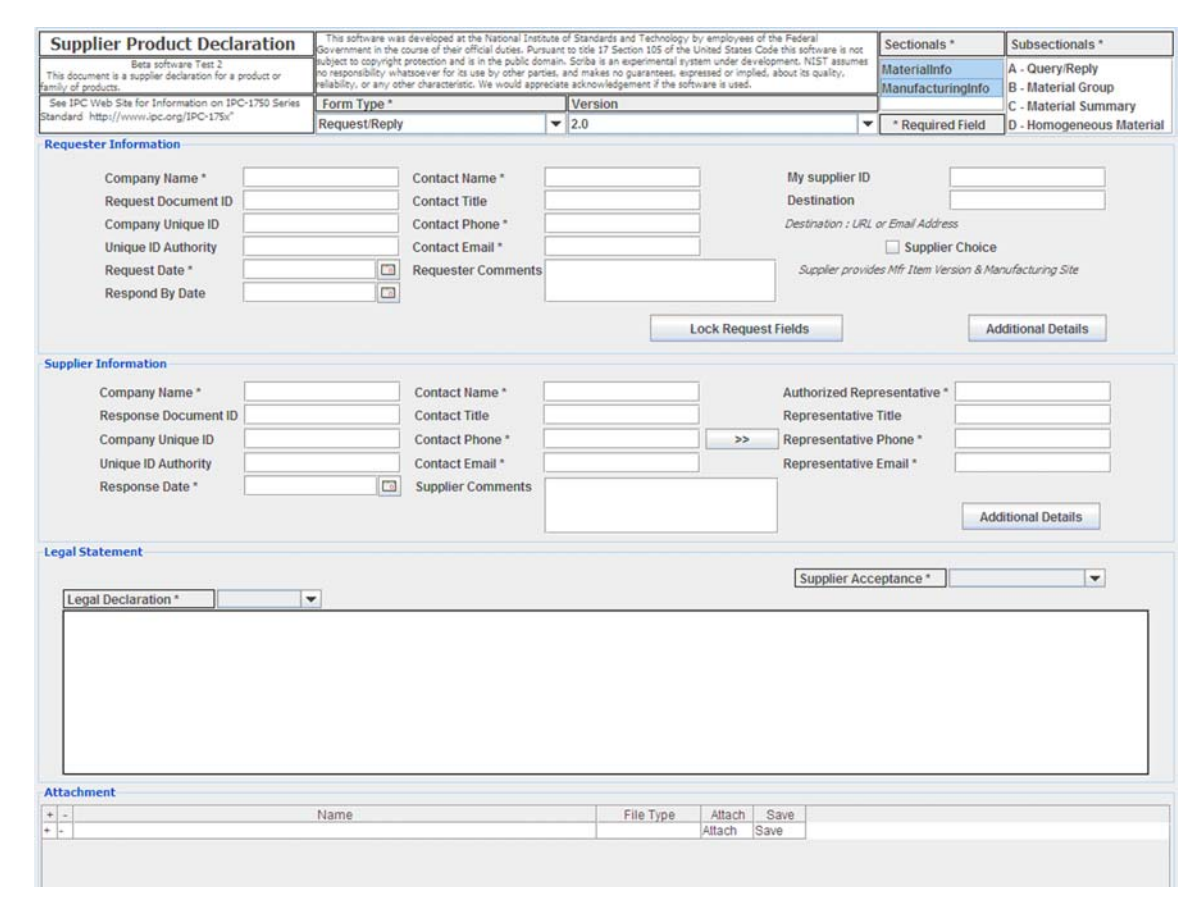
**Foreword**

While IPC-1751 defines the generic requirements for declaration process management, IPC-1756 establishes a standard reporting format for manufacturing process data between supply chain participants and supports the reporting of components, printed circuit boards, sub-assemblies, and products which will be used in further manufacturing processes utilizing reflow and wave soldering techniques. This standard defines the content and requirements for reporting manufacturing process information.

The enactment of *Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003, on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment*, drove industry use of solders that have higher processing temperatures and thus the need for the reporting of soldering capabilities.

This standard is supported by software developed at the National Institute of Standards and Technology (NIST) by employees of the US Federal Government in the course of their official duties. Pursuant to title 17 Section 105 of the United States code, the software is not subject to copyright protection and is in the public domain. The software known as ''Scriba'' can be used to create the information needed between User and Supplier as defined in the IPC-175X series of standards. The output of Scriba can be saved as a graphic and is based on an underlying Extensible Markup Language (XML) schema, which in turn is represented by a Unified Modeling Language (UML) model. The NIST tool and XML schema are available for free download at www.ipc.org.

End product producers and customers throughout the supply chain are resquesting that suppliers provide information about the products that they produce as well as certain material declarations so that the recipient is aware of the presence and amount of certain chemicals in the items it procures. The IPC-175X standards are intended to provide for the creation of an electronic record that will serve as a standard way for reporting or collecting this type of data. The following figure is the opening screen of the NIST tool.




**Initial Screen for Requester/Supplier Product Descriptions**

# Acknowledgment

Any document involving a complex technology draws material from a vast number of sources. While the principal members of the Manufacturing Process Declaration Task Group (2-18a) of the Supplier Declaration Subcommittee (2-18) are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of the IPC extend their gratitude.

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Curtis Grosskopf, IBM Corporation

***Additionally, we would like to thank the National Institute of Standards and Technology (NIST) for their significant contributions to the development of this standard.***

# Table of Contents

# Manufacturing Process Data Management

## 1 SCOPE

This standard establishes the requirements for exchanging manufacturing data between suppliers and their customers for electrical and electronic product. This standard applies to products, components, subproducts and materials that are supplied to producers of electrical and electronic components for incorporation into their products. It covers assembly materials and manufacturing data in order to facilitate and identify the process sensitivity of the products, components and subproducts. It does not apply to packing materials (e.g., cardboard, plastic tray, etc.).

The standard applies to business-to-business transactions. It is not intended to be used by the general public when making purchasing decisions.

### 1.1 Purpose

This standard is intended to benefit suppliers and their customers by providing consistency and efficiency to the manufacturing data declaration process. It establishes standard data exchange techniques and electronic data exchange formats that will facilitate and improve data transfer along the entire global supply chain.

### 1.2 Classification

This standard establishes 23 fields for declaration of manufacturing data. These fields are supported by Scriba and other tools developed between users and suppliers. The data descriptions **shall** incorporate the requirements of the IPC-1751 for generic company information. As such, the IPC-1751 becomes a ***mandatory*** part of this standard, and all conditions apply to the characteristics of the data structure as defined by the XML schema and the Scriba data capture tool. See Figure 1-1.

The Product tab is the link between the product(s) defined in IPC-1751 and IPC-1752. This link may establish the relationship of the manufacturing process information covered in IPC-1756 with the product object identified in IPC-1751 and any of the four use case conditions described in IPC-1752.

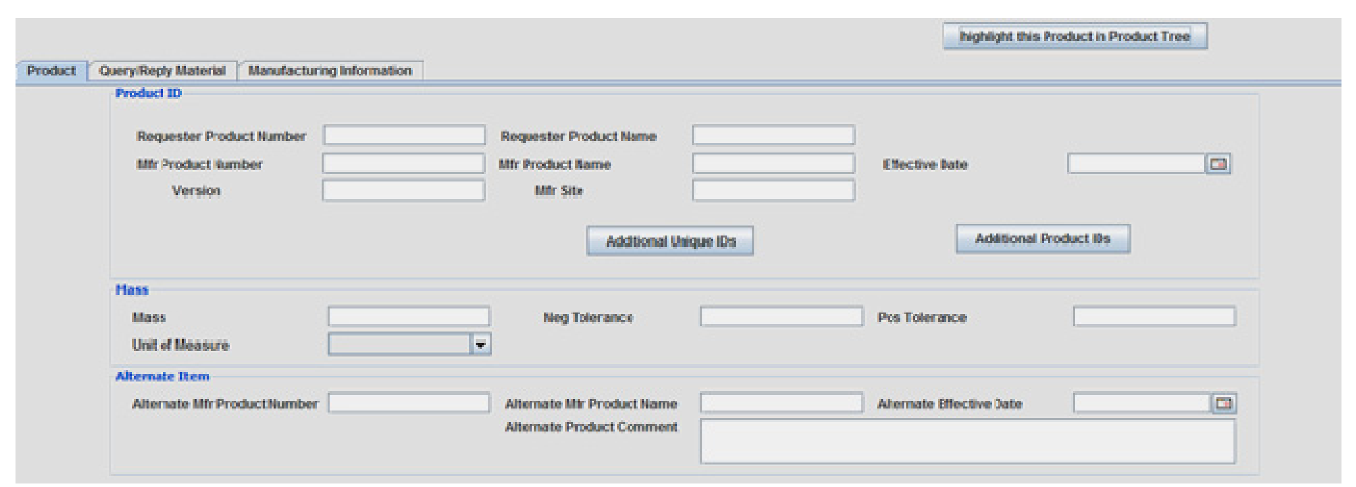



**Figure 1-1 Scriba Image Needed to Define Manufacturing Process Information**

## 1.3 Manufacturing Data Fields

There are 22 fields available for providing manufacturing information. The fields are organized according to the use and relate to the product package configuration, its material properties and the process sensitivity. The individual fields are:

- Package Configuration
- J-STD-020 MSL Rating
- J-STD-020 Classification Temperature ($T_C$)
- J-STD-020 Time Within 5°C of $T_C$
- Component Ramp-Up Rate
- Preheat Maximum Temperature
- Preheat Duration
- Component Temperature Spike
- Time Limitation Above 217°C
- Component Ramp Down Rate
- Maximum Number of Solder Process Cycles
- Wave Solder Temperature (max.)
- Total Time in Wave (max.)
- Terminal Shape
- Terminal Size
- Terminal Instances
- Terminal Base Alloy
- Terminal Plating
- Ball Array Material
- J-STD-075 PSL Rating
- PSL Additional Information
- Comments (Additional Manufacturing Process Information/Tin Whisker Mitigation)

Figure 1-2 shows an example of a tool image used to capture the information for the process details. This figure relates to the product object or product family described in the product tree of IPC-1752 when the sectional tabs of “Manufacturing Information” have been highlighted.

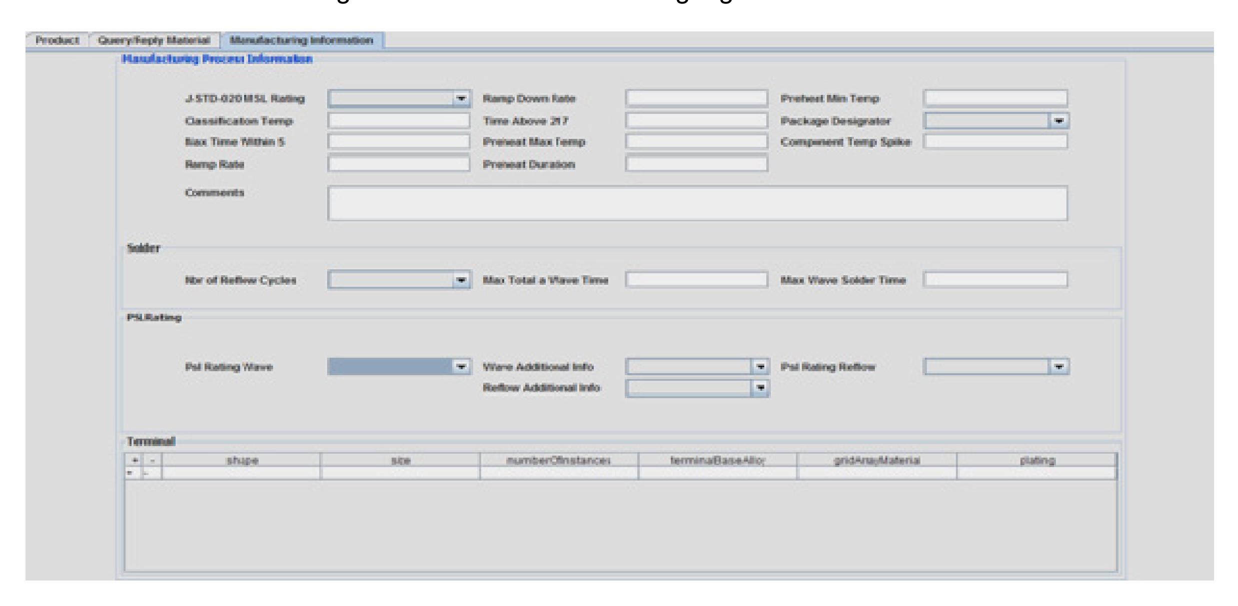



**Figure 1-2 Manufacturing Process Information Image Example**

Since the 1751 support four use cases a set of products (Product Tree) can be developed that groups all related products into a single use case to which the processes shown in Figure 2 pertain.

### 1.4 Interpretation

The word **''shall,''** the emphatic form of the verb, is used throughout this standard whenever a requirement is intended to express a provision that is ***mandatory***. Deviation from a **''shall''** requirement may be considered if sufficient data is supplied to justify the exception. The words ''should'' and ''may'' are used to express non-mandatory provisions intended to be recommendations. ''Will'' is used to express a declaration of purpose related to the text description. To assist the reader, the word **''shall''** is presented in bold characters.

### 1.5 Presentation

All dimensions and tolerances in the IPC-175X standard series are expressed in metric units with millimeters the main form of dimensional expression. Inches may be shown in brackets as appropriate and are not always a direct conversion depending on round-off discrepancies or the required precision. Users are cautioned to employ a single dimensioning system and not intermix millimeters and inches. Temperature is only expressed in SI degrees representing Celsius measurement. The measurement of volume and mass (weight) **shall** also be in SI units. Reference information is shown in parentheses ( ).

## 2 APPLICABLE DOCUMENTS

The following documents form a part of this standard to the extent specified herein. The revision of the document in effect at the time a declaration is produced **shall** take precedence.

### 2.1 IPC[1]

IPC-T-50 *Terms and Definitions for Interconnecting and Packaging Electronic Circuits*

IPC-1751 *Generic Requirements for Declaration Process Management*

IPC-1752 *Material Declaration Management*

IPC-7351 *Generic Requirements for Surface Mount Design and Land Pattern Standard*

### 2.2 Joint Industry Standards (ECA, IPC, JEDEC)

IPC/JEDEC J-STD-020 *Moisture/Reflow Sensitivity Classification for Non-hermetic Solid State Surface Mount Devices*

ECA/IPC/JEDEC J-STD-075 *Classification of Non-IC Electronic Components for Assembly Processes*

IPC/JEDEC JP002 *Current Tin Whiskers Theory and Mitigation Practices Guideline*

### 2.3 JEDEC[2]

JEDEC JESD22A111 *Evaluation Procedure for Determining Capability to Bottom Side Board Attach by Full Body Solder Immersion of Small Surface Mount Solid State Devices*

JEDEC JESD30 *Descriptive Designation System for Semiconductor-Device Packages*

### 2.4 IEC[3]

IEC 60194 *Printed board design, manufacture and assembly – Terms and definitions*

[1] www.ipc.org
[2] www.jedec.org
[3] www.iec.ch

### 2.5 RoHS Directive[4]

*Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment*

## 3 GENERAL REQUIREMENTS

The following requirements are applicable to all the IPC-175X series of declaration management standards. In the event that a particular requirement does not apply, the alternate methodology is defined in the sectional standard.

### 3.1 Data Model

The data model for the IPC-175X series is described in the 1751 standard, and is a simplified representation of a system that ignores extraneous details in order to concentrate on some particular aspect of the system. Models are useful tools for understanding and explaining the operation of any system. An information model is an abstract view of a system that specifies and describes the information used by the system. The most useful information models describe constraints on information, and relationships between information.

Figure 3-1 shows the overview of how the manufacturing process data fits into the overall declaration model used in the 175X series of standards.

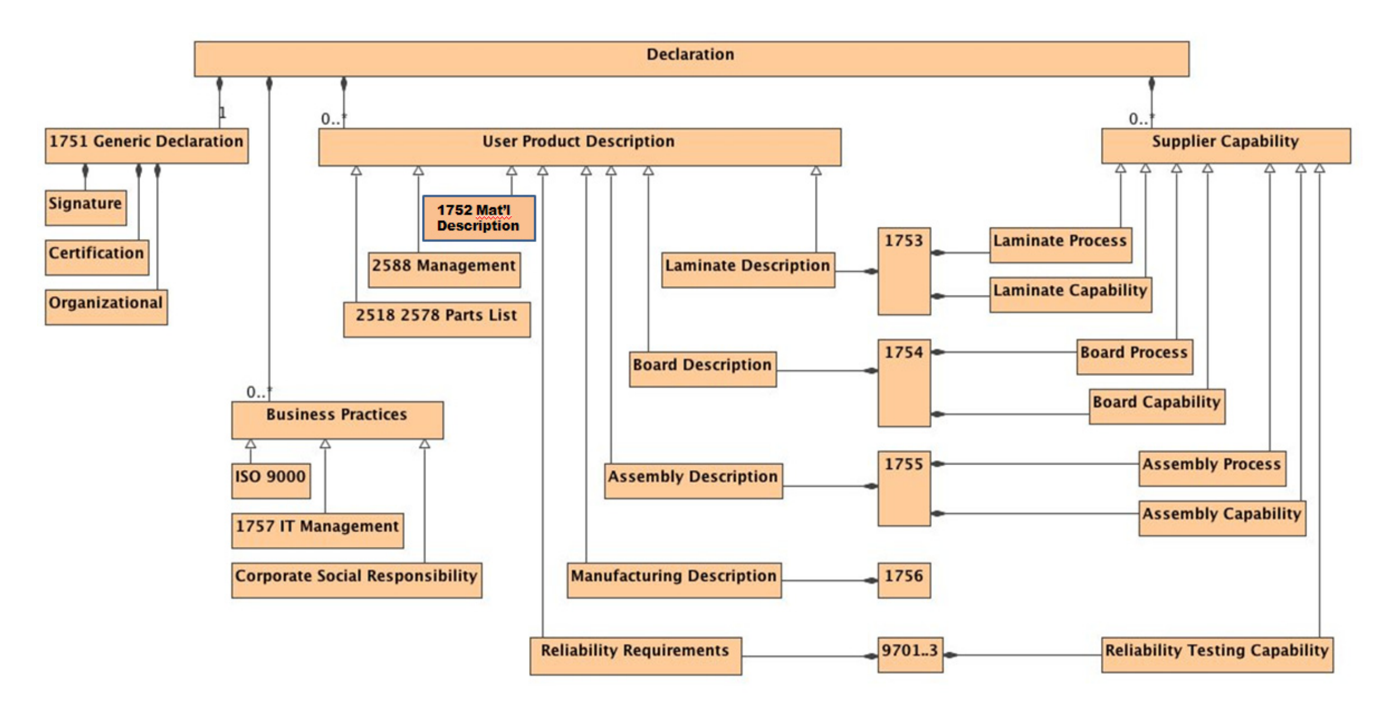



**Figure 3-1 Declaration Management Overview Data Model**

The data model for the declaration standard is not complex; however, there are many relationships and linkages that need to be addressed and established. Data modeling can improve the characteristics of any form or any programming that is developed at the requester's site or the responder's location.

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### 3.2 Business Process

The business process models and supply chain interactions are defined in the IPC-1751 generic standard. In addition, IPC-1752 has been upgraded to permit multiple part descriptions and is supported by Version 2.0 of the XML schema. Now one declaration may contain data related to a number of products. Full product identification for each product may now be provided.

Materials are identical when the substance content and the concentration of those substances within the compared materials have no differences. It should also be noted that at times the manufacturing process data can apply to the multiple product types depending on the product scenario.

As part of managing the declaration flow the term “multiple parts” refers to the ability to associate multiple product identities with one declaration. The different types of multiple product declarations have been broken down into multiple product scenarios and are based on the material declaration concepts. These concepts have been split into four use cases that describe the multiple parts use cases supported by the IPC-1751 and IPC-1752 standards. The four use cases are:

1) Included products have the same mass and material content;
2) Included products have different mass with the same material content;
3) Included products have the same mass with different material content; and
4) Included products have different mass and different material content.

All four use cases may be used for providing the optional manufacturing process information. Since the process data relates to the “Package” being assembled it is incumbent on the requester and supplier to be clear and unambiguous as to the relationship that is pertinent between the parts, package and the appropriate process data.

As an example, a Use Case 1 product description would allow the manufacturing process data to apply since the parts are essentially similar in physical condition. i.e., a family of surface mounted ceramic capacitors of varying ESR (Equivalent Series Resistance) values or a family of resistors with varying resistance values

The descriptions shown for Use Case 2, 3 and 4 would also be applicable for appropriate manufacturing process data addition.

#### 3.2.1 Request/Response (Pull)

Since requests for information can come from various sources the request identified by the requirements of IPC-1751 **shall** specifically identify which sectional standard(s) are applicable and how the data should be combined. The requester details per IPC-1751 may be part of a procurement contract, request for quote/information, or simply a request for data. The data requested is defined under the scope of the IPC-1751 standard; the manufacturing process information defined **shall** be in accordance with this standard and be linked to the product description in a manner to avoid ambiguity, as the declaration may be for a single product or a product family.

A company receiving a request should confirm with the requester any ambiguity in the request. Specific information about the request may be attached to the request, or may be provided on a web page which is described in the request. The company receiving the request should then decide whether to respond to the request for manufacturing process data. While not responding to a request to provide information is always an option (the XML schema shows the attributes as being optional), the supplier should always consider the business implications of this course of action.

#### 3.2.2 Distribute (Push)

The supplier may distribute declaration information and the appropriate sectional content as a published report. This most often will be accomplished by making documents available on a corporate web site, or having them available internally for submission to a requester when a request is received. In this latter

case, it will be important that the information in the requester fields be included with the response. These fields contain information that permit the requester to systematically tie the response to the request. In addition, any manufacturing information defined by this sectional **shall** be properly linked to the appropriate product.

The XML data or any data transfer media **shall** indicate "Distribute" when publishing data about the product and manufacturing process conditions. See Figure 3-2.

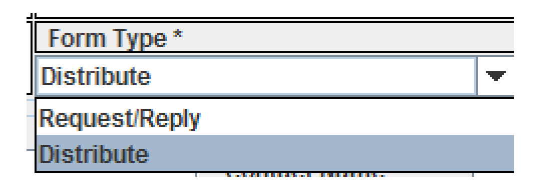



**Figure 3-2 Form Type Distribute**

Under the publication process, the structure for generic information is combined with the requirements of the appropriate sectional information and then published as a unique description related to a specific part. The publication **shall** follow the IPC-1751 generic standard and the appropriate sectional information related to the declaration activity. The manufacturing information may be added into a single or group product XML file, properly linked to multiple files or supplemented by hard copy information.

## 3.3 Terms and Definitions

The definition of all terms **shall** be in accordance with the terms defined in IPC-1751, IPC-T-50 and the following. An asterisk (*) by the term indicates that it is a reproduction from IPC-T-50 and is provided to assist the reader in interpretation of this standard.

### 3.3.1 family

A grouping of components by similar/common characteristics (e.g., package, design, materials, function, technology and or manufacturing process).

### 3.3.2 group

Any set of products with commonality between them, such as a part family, the components of an assembly, or any other grouping as determined relevant in the exchange of data between the Supplier and User.

### 3.3.3 moisture sensitivity level (MSL)

A rating indicating a component's susceptibility to damage due to absorbed moisture when subjected to reflow soldering (see J-STD-020).

### 3.3.4 process sensitivity level (PSL)

A rating used to identify a component that is solder process sensitive because the component cannot be used in one or more of the base solder process conditions (see J-STD-075).

### 3.3.5 paste-in-hole (PIH)*

A process in which the solder paste for the through hole component is applied using a stencil or syringe to accommodate through-hole components that are inserted and reflow-soldered together with the surface-mount components. (Also commonly called Intrusive Soldering)

### 3.3.6 product

Any substance, material, sub-part, part, sub-assembly, or assembly, up to a completed original manufacturer's assembly that is the subject of a declaration.

### 3.3.7 through-hole technology (THT)*

The electrical connection of components to a conductive pattern by the use of component holes.

### 3.3.8 through-hole component (THC)

A component which is mounted to a printed board by insertion of leads through holes.

## 3.4 Manufacturing Information Structure

The XML Schema for manufacturing information consists of the relationship between the product description including name, number, manufacturing site, etc., which is identified as the “Package” in the XML schema, and the information about the manufacturing process and its pertinent characteristics. See Figure 3-3.

Additional comments may be added as a separate attribute to the Package element. When the enumeration “NAC” (Not Applicable – Comment) is specified for any of the descriptions of the Package manufacturing process data defined in this standard, a comment is required and **shall** be linked to the attribute to which the “Not Applicable” pertains.

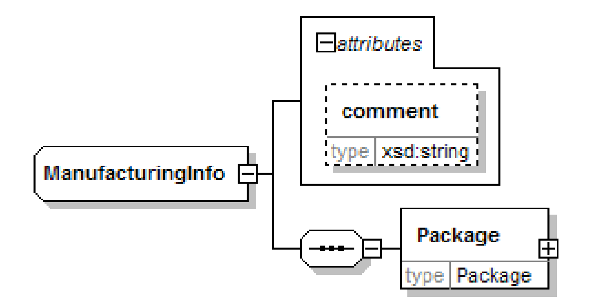



**Figure 3-3 Manufacturing Information Structure**

# 4 DESCRIPTION OF THE MANUFACTURING DATA FIELDS

The details for the manufacturing information are contained in the attributes of the Package element. Additional conditions are defined in the attributes of the three element children of Package (Solder, Terminal, and PSLRating) which further describe processing conditions as shown in Figure 4-1. Although the manufacturing process data is mostly optional, and the information in this section may not be applicable to all products, the need for the information requested should be addressed wherever possible.

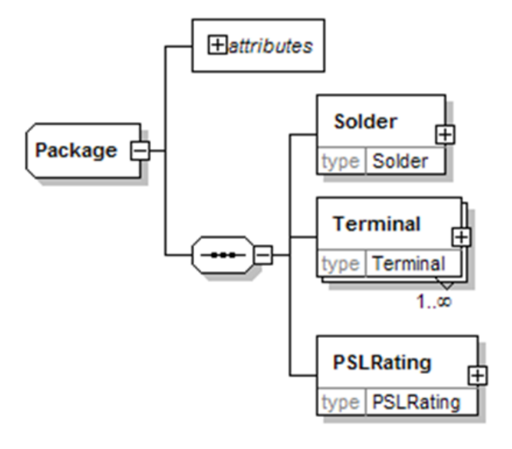



**Figure 4-1 Package Manufacturing Information Structure**

## 4.1 Package

The package element consists of a series of attributes that relate specifically to the product(s) described by the 1751 data identification (Product ID). This is usually a part that can be identified by a manufacturer's product number. The manufacturing process information supplied **shall** apply to the specific part number(s) of the product ID no matter which of the four use cases described in section 3.2 are defined. The following sections describe the attributes of the Package element.

### 4.1.1 Package Configuration

The package configuration **shall** meet the requirements of the naming convention and enumerations to be used as packageDesignators shown in Table 4-1. Included in the designator descriptions is the term "NAC" to indicate that none of the acronyms are appropriate and a comment is included in the "manufacturingInfo" comment element. (See also JEDEC JESD30).

**Table 4-1 Package Designators**

| Basic package designator | Common package name | Description |
|---|---|---|
| **AXL** | Axial leaded thru-hole | An axial leaded through hole mounted |
| **BGA** | Ball grid array | A grid-array package with balls or bumps on the bottom surface |
| **CGA** | Column grid array | A grid-array package with columns on the bottom surface |
| **CHP** | Chip component | A chip component with metalized leads on opposite sides |
| **DIM** | Dual in-line module | An in-line module with terminal pad surfaces on both surfaces of a printed circuit board substrate |
| **DIP** | Dual in-line package | An in-line package with leads in parallel rows on opposite sides of the package body and intended for through-hole insertion into a circuit board |
| **DSO** | Dual small-outline package | A dual small outline package with gull-wing-shaped leads on two opposite sides |
| **DSB** | Die-size BGA | A BGA that is the size of the die it contains and whose size will change with changes in die size |
| **LGA** | Land grid array | A grid-array package with plated terminal pads on the bottom surface |
| **PGA** | Pin grid array | A grid-array package with pins protruding from the bottom surface |
| **QFF** | Quad flatpack flat leads | A flat-type package with flat, unformed leads extending from four sides |
| **QFJ** | Quad flatpack J - leads | A flat-type package with J-shaped leads on four sides |
| **QFN** | Quad flatpack no leads | A flat-type package with terminal pads (no leads) along the four edges of the bottom surface |
| **QFP** | Quad flatpack | A flat-type package with gull-wing-shaped leads on four sides |
| **RAD** | Radial lead thru-hole | A radial leaded through hole mounted part |
| **SIM** | Single in-line module | An in-line module with terminal pad surfaces on only one surface of a printed circuit board substrate |
| **SIP** | Single in-line package | An in-line package with leads on only one side |
| **SMC** | Surface connector | A connector intended to be surface mounted |
| **SMO** | Surface mount odd parts | Any odd part with leads or terminations intended to be mounted on the surface of the board |
| **SOF** | Small outline flat leads | A small-outline package with unformed (flat) leads on two opposite sides |
| **SOJ** | Small outline J – leads | A small-outline package with J-shaped leads on two opposite sides |
| **SON** | Small outline no leads | A small-outline package with terminal pads along two opposite edges of the bottom surface |
| **SOT** | Small outline transistor | A small outline transistor with metal terminations on the underside |
| **SVP** | Vertical surface Mount | A vertical surface-mount package with supporting posts |
| **THC** | Thru-hole connector | A connector whose pins are intended to be mounted in through holes |

| Basic package designator | Common package name | Description |
|---|---|---|
| **THO** | Thru-hole odd parts | Any odd part with leads intended to be mounted through the board |
| **UCI** | Tape carrier package | An uncased chip with leads extending outward in four directions on an insulating film |
| **WLB** | Wafer-level BGA | A BGA that is processed on an entire wafer before singulation rather than on an individual die, and whose size will change with changes in die size |
| **ZIP** | Zig-zag in-line package | An in-line package with zig-zag leads on only one side for through-hole insertion into a printed circuit board |
| **NAC** | Not applicable outline | None of the descriptions fit – add comment to manufacturingInfo |

```
<xsd:attribute name="packageDesignator">
  <xsd:simpleType>
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="AXL"/>
      <xsd:enumeration value="BGA"/>
      <xsd:enumeration value="CGA"/>
  <xsd:enumeration value="CHP"/>
      <xsd:enumeration value="DIM"/>
      <xsd:enumeration value="DIP"/>
      <xsd:enumeration value="DSO"/>
      <xsd:enumeration value="DSB"/>
      <xsd:enumeration value="LGA"/>
      <xsd:enumeration value="PGA"/>
      <xsd:enumeration value="QFF"/>
      <xsd:enumeration value="QFJ"/>
      <xsd:enumeration value="QFN"/>
      <xsd:enumeration value="QFP"/>
      <xsd:enumeration value="RAD"/>
      <xsd:enumeration value="SIM"/>
      <xsd:enumeration value="SIP"/>
  <xsd:enumeration value="SMC"/>
      <xsd:enumeration value="SMO"/>
      <xsd:enumeration value="SOF"/>
      <xsd:enumeration value="SOJ"/>
      <xsd:enumeration value="SON"/>
      <xsd:enumeration value="SVP"/>
      <xsd:enumeration value="THC"/>
      <xsd:enumeration value="THO"/>
      <xsd:enumeration value="UCI"/>
      <xsd:enumeration value="WLB"/>
      <xsd:enumeration value="ZIP"/>
      <xsd:enumeration value="NAC"/>
    </xsd:restriction>
  </xsd:simpleType>
 </xsd:attribute>
```

Note: “NAC” requires a notation in the Manufacturing Information comment element

### 4.1.2 J-STD-020 MSL Rating

The J-STD-020 MSL Rating is the moisture sensitivity level in accordance with J-STD-020. The MSL rating is an enumerated string as illustrated by Table 4-2. Included in the MSL rating descriptions is the term "NAC" to indicate that none of the floor life values are appropriate and a comment is included in the "manufacturingInfo" comment element.

**Table 4-2 Moisture Sensitivity Rating per J-STD-020**

```
<xsd:attribute name="mslRating">
  <xsd:simpleType>
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="1"/>
      <xsd:enumeration value="2"/>
      <xsd:enumeration value="2a"/>
      <xsd:enumeration value="3"/>
      <xsd:enumeration value="4"/>
      <xsd:enumeration value="5"/>
      <xsd:enumeration value="5a"/>
      <xsd:enumeration value="6"/>
      <xsd:enumeration value="NAC"/>
    </xsd:restriction>
  </xsd:simpleType>
</xsd:attribute
```

| Level | Floor Life | |
|---|---|---|
| | Time | Condition |
| 1 | Unlimited | ≤30 °C/85% RH |
| 2 | 1 year | ≤30 °C/60% RH |
| 2a | 4 weeks | ≤30 °C/60% RH |
| 3 | 168 hours | ≤30 °C/60% RH |
| 4 | 72 hours | ≤30 °C/60% RH |
| 5 | 48 hours | ≤30 °C/60% RH |
| 5a | 24 hours | ≤30 °C/60% RH |
| 6 | Time on Label (TOL) | ≤30 °C/60% RH |

Note: "NAC" requires a notation in the Manufacturing Information comment element

### 4.1.3 J-STD-020 Classification Temperature ($T_C$)

The top dead center body temperature during reflow soldering to which the J-STD-020 MSL and the J-STD-075 PSL classifications apply. The data type for the Classification Temperature is a floating point number.

```
<xsd:attribute name="ClassificationTemp" type="xsd:float"/>
```

### 4.1.4 J-STD-020 Time within 5°C of $T_C$

The maximum time (in seconds) within 5°C of $T_C$ (classification temperature per J-STD-020) that should not be exceeded by the product in order to ensure assembly reliability. For process sensitive components, see J-STD-075; this value may be different than that shown in J-STD-020. The data type for the allowable time at the maximum temperature is a floating point number. Product with a J-STD-020 Time Within 5°C of $T_C$ limitation requires that a third character (G) be added to the PSL rating defined in paragraph 4.4 and Table 4-8.

```
<xsd:attribute name="maxTimeWithin5" type="xsd:float"/>
```

### 4.1.5 Component Ramp Up Rate

Component Ramp Up Rate is the maximum change in component body temperature over time (in °C/second) that should not be exceeded by the product in order to ensure assembly reliability. The maximum time may be different than that shown in J-STD-020. The data type for the temperature ramp rate is a floating point number. Product with a Temperature Ramp Up Rate limitation requires that a third character (Y) **shall** be added to the PSL rating defined in 4.4 and Table 4-8. It should be noted. (see 4.1.10).

```
<xsd:attribute name="componentRampUpRate" type="xsd:float"/>
```

### 4.1.6 Preheat Maximum Temperature

Preheat Maximum Temperature is the highest temperature to which a process sensitive component may be subjected just prior to actual soldering process entry (other than the 200°C value stated in the J-STD-020 classification profile) in order to ensure the integrity and reliability of the product. The data type for the preheat maximum temperature is a floating point number. Product with a Preheat Maximum Temperature limitation requires that a third character (C) **shall** be added to the PSL rating defined in 4.4 and Table 4-8.

```
<xsd:attribute name="preheatMaxTemp" type="xsd:float"/>
```

### 4.1.7 Preheat Duration

Preheat Duration is the length of time a process sensitive component can be subjected to the Preheat Maximum Temperature (other than the 60-120 second value stated in the J-STD-020 classification profile) in order to ensure the integrity and reliability of the product. The data type for the preheat duration is a floating point number. Product with a Preheat Duration limitation requires that a third character (C) **shall** be added to the PSL rating defined in 4.4 and Table 4-8.

```
<xsd:attribute name="preheatTime" type="xsd:float"/>
```

### 4.1.8 Component Temperature Spike

Component Temperature Spike is the maximum difference in temperature between the components' preheat exit temperature and its temperature upon contacting the solder wave in order to ensure the integrity and reliability of the product. The data type for the component temperature spike is a floating point number. Product with a Component Temperature Spike limitation requires that a third character (A) **shall** be added to the PSL rating defined in 4.4 and Table 4-8.

```
<xsd:attribute name="componentTempSpike" type="xsd:float"/>
```

### 4.1.9 Time Limitation Above 217°C

Time Limitation Above 217°C is the maximum time in seconds that the product can tolerate above the melting (liquidus) temperature of commonly used lead-free solders. The data type for the time limitation above 217°C is a floating point number. Product with a Time Limitation Above 217°C limitation requires that a third character (F) **shall** be added to the PSL rating defined in 4.4 and Table 4-8.

```
<xsd:attribute name="timeAbove217" type="xsd:float"/>
```

### 4.1.10 Component Ramp Down Rate

Component Ramp down rate is the average cooling rate limitation for the component and is described in degrees Centigrade per second. The data type for the cooling ramp down rate is a floating point number. Product with a Component Ramp Down Rate limitation requires that a third character (H) **shall** be added to the PSL rating defined in 4.4 and Table 4-8.

```
<xsd:attribute name="componentRampDownRate" type="xsd:float"/>
```

## 4.2 Solder

The solder element defines the soldering parameters that the product identified by the Package ID can withstand. The XML element <Solder> contains the attributes related to the soldering process. Except for the enumerations defined for the number of solder process cycles the other two optional attributes define the temperature and time restrictions as shown in Figure 4-2.

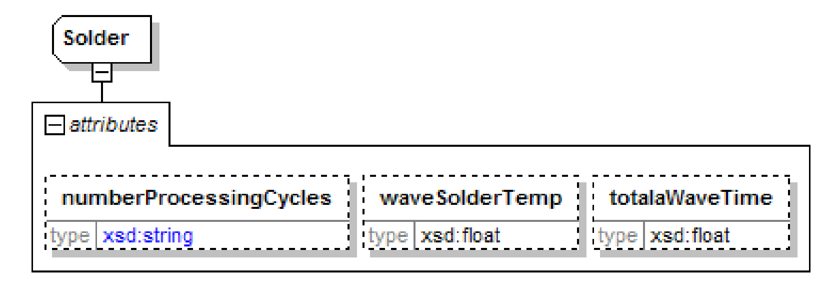



**Figure 4-2 Soldering Attributes**

### 4.2.1 Maximum Number of Solder Processing Cycles

The maximum number of solder processing cycles is the maximum permissible number of surface mount assembly or other solder attach processes (including rework and reuse if using the same parameters as specified in the original process envelope) to which the product can be subjected while ensuring assembly reliability at the peak process body temperature and maximum time at peak temperature. For process sensitive components see J-STD-075; this value may be different than that shown in J-STD-020. The attribute for the number of solder cycles is an enumerated string as shown in Table 4-3. Included in the maximum number of solder processing cycle descriptions is the term “NAC” to indicate that none of the values are appropriate and a comment is included in the “manufacturingInfo” comment element.

**Table 4-3 Enumerations for Number of Process Cycles**

```
<xsd:attribute name="numberProcessingCycles">
  <xsd:simpleType>
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="1"/>
      <xsd:enumeration value="2"/>
      <xsd:enumeration value="3"/>
      <xsd:enumeration value="4"/>
      <xsd:enumeration value="5"/>
      <xsd:enumeration value="6"/>
      <xsd:enumeration value="7"/>
      <xsd:enumeration value="8"/>
      <xsd:enumeration value="9"/>
      <xsd:enumeration value="10"/>
      <xsd:enumeration value="NAC"/>
    </xsd:restriction>
  </xsd:simpleType>
</xsd:attribute>
```

Note: “NAC” requires a notation in the manufacturing Information comment element

### 4.2.2 Wave Solder Temperature (max.)

Wave Solder Temperature (max.) is the temperature that should not be exceeded during wave soldering assembly or other solder attach processes (including rework and reuse if using the same parameters as specified in the original process envelope) in order to ensure the integrity and reliability of the product. The data type for the maximum wave solder temperature is a floating point number.

```
<xsd:attribute name="waveSolderTemp" type="xsd:float"/>
```

### 4.2.3 Total Time in Wave (max.)

Total Time in Wave (max.) is the maximum time (in seconds) that through-hole component leads or SMT component bodies (submersion in solder) should not exceed in order to ensure the integrity and reliability of the product. The data type for the maximum total time in the wave is a floating point number.

```
<xsd:attribute name="totalWaveTime" type="xsd:float"/>
```

## 4.3 Terminal

The Terminal element consists of several optional attributes, most of which are enumerated string data. The XML schema contains the allowable enumerations, and are shown under the appropriate manufacturing information category. See Figure 4-3.

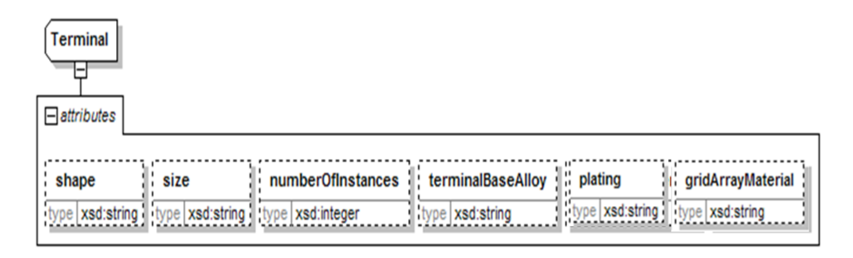



**Figure 4-3 Terminal Attributes**

### 4.3.1 Terminal Shape

The terminal shape **shall** meet the requirements shown as the details for the enumerations in Table 4-4. Included will be the term “NAC” to indicate that none of the enumerations are appropriate.

**Table 4-4 Terminal Shape Form Enumerations**

| Form/shape | Description |
|---|---|
| **Bulk solder** | A bulk solder termination for attachment perpendicular to the land structure in the shape of a ball, column, or pillar |
| **C bend** | A C-shaped noncompliant lead bent down and under the package body |
| **Solder lug** | A lug terminal on the package |
| **Flat** | A compliant, or noncompliant, unformed flat lead that extends away from the body of the package |
| **Gull wing** | A compliant lead bent down from the body of the package with a foot at the end pointing away from the package |
| **High-current cable** | A lug terminal at the end of a flexible lead |
| **Insulated** | A flat lead formed by depositing a thin conductor onto a insulating film |
| **J bend** | A J-shaped compliant or noncompliant lead bent down and back under the body of the package |
| **L bend** | An L-shaped compliant lead intended for surface mounting |
| **No lead** | Metallized terminal pads located on the bottom surface of the package |
| **Pin** | A tempered lead extending from the body of the package and intended for insertion into a plated through-hole in a printed circuit board or into a socket |
| **Quick connect** | A tab-like terminal extending from the body of the package |
| **Wraparound** | A metallized noncompliant terminal wrapped around the package body |
| **S bend** | An S-shaped compliant lead bent under the body of the package |
| **Through-hole** | A terminal with a circular, flat, or V-shaped cross section intended for attachment to a through-hole in the land structure |
| **J inverted** | A J-shaped compliant or noncompliant lead bent down from the body of the package with the curved end pointing away from the package |
| **Wire** | A wire lead extending from the body of the package |
| **Screw** | A threaded hole |
| **NAC** | Not applicable No match to the lead shape – add comment to manufacturingInfo |

```
<xsd:attribute name="shape">
  <xsd:simpleType>
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="Bulk solder"/>
      <xsd:enumeration value="C bend"/>
      <xsd:enumeration value="Solder lug"/>
      <xsd:enumeration value="Flat"/>
      <xsd:enumeration value="Gull wing"/>
      <xsd:enumeration value="High-current cable"/>
      <xsd:enumeration value="Insulated"/>
      <xsd:enumeration value="J bend"/>
      <xsd:enumeration value="L bend"/>
      <xsd:enumeration value="No lead"/>
      <xsd:enumeration value="Pin"/>
      <xsd:enumeration value="Quick connect"/>
      <xsd:enumeration value="Wraparound"/>
      <xsd:enumeration value="S bend"/>
      <xsd:enumeration value="Through-hole"/>
      <xsd:enumeration value="J inverted"/>
      <xsd:enumeration value="Wire"/>
      <xsd:enumeration value="Screw"/>
      <xsd:enumeration value="NAC"/>
    </xsd:restriction>
  </xsd:simpleType>
</xsd:attribute>
```

Note: “NAC” requires a notation in the manufacturing Information comment element

### 4.3.2 Terminal Size

The terminal size is a string and indicates the minimum size and shape of the metallic land pattern for proper attachment of the package to the mounting substrate. The shape may be round, oval, rectangular, square or octagonal. An example is shown in Figure 4-4 for the footprint of a QFN.

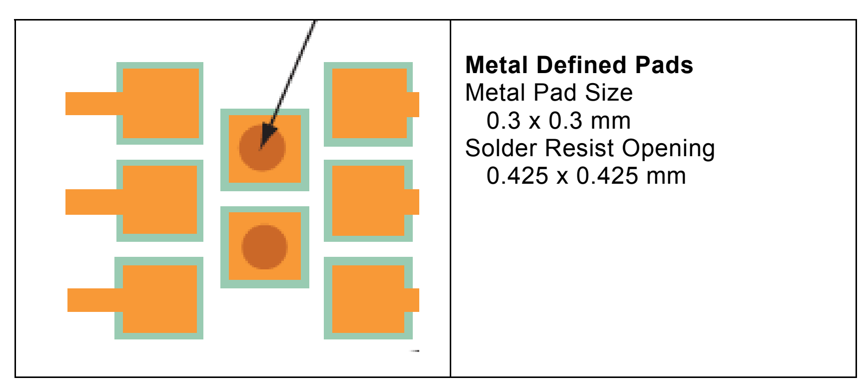



**Figure 4-4 Terminal Size for Mounting a QFN Package**

```
<xsd:attribute name="size" type="xsd:string"/>
```

Examples: Square - 0.3 x 0.3 mm; Round – 0.4 mm Dia; Oval – 1.2 x 0.6 mm

### 4.3.3 Number of Instances

The number of instances is defined as an integer that includes all terminations of the product including those that may be required for electrical, mechanical, or thermal attachment.

```
<xsd:attribute name="numberOfInstances" type="xsd:integer"/>
```

### 4.3.4 Terminal Base Alloy

The terminal base alloy is the base material of the lead or lead frame without plating. The terminal shape may be a through-hole pin, gull wing, J-lead or other configuration. The base alloy is an enumerated string according to Table 4-5. Included will be the term “NAC” to indicate that none of the enumerations are appropriate.

**Table 4-5 Terminal Base Alloy**

| Material | XML |
|---|---|
| Alloy 42 | <xsd:attribute name="terminalBaseAlloy"><br><xsd:simpleType><br><xsd:restriction base="xsd:string"><br><xsd:enumeration value="Alloy 42"/> |
| Copper Alloy | <xsd:enumeration value="Copper Alloy"/> |
| Beryllium Copper | <xsd:enumeration value="Beryllium Copper"/> |
| Brass | <xsd:enumeration value="Brass"/> |
| Phosphor Bronze | <xsd:enumeration value="Phosphor Bronze"/> |
| Kovar | <xsd:enumeration value="Kovar"/> |
| | |
| Not Applicable - Comment | <xsd:enumeration value="NAC"/><br></xsd:restriction><br></xsd:simpleType><br></xsd:attribute> |

Note: “NAC” requires a notation in the manufacturing Information comment element

### 4.3.5 Terminal Plating

The terminal plating finish material used on the item to make an electrical or thermal connection, sometimes referred to as ‘Second Level Interconnect.’ An example of this would be the plating on the lead frame of a component such as a TSOP integrated circuit device or the plating on the leads of a through-hole component. The plating attribute is an XML enumeration string.

```
<xsd:attributename="plating"><xsd:simpleType>
    <xsd:restriction base="xsd:string">.
```

The enumerations are shown in Table 4-6. Included will be the term “NAC” to indicate that none of the enumerations are appropriate and a comment is required as to the plating condition.

**Table 4-6 Listing of Possible Selections for Terminal Plating**

| | |
|---|---|
| Gold (Au) | Tin (Sn), matte, annealed |
| Gold (Au), electroplated | Tin (Sn), matte, fused |
| Gold (Au), hard | Tin (Sn), matte, reflowed |
| Indium (In) | Tin (Sn), matte, reflowed over Nickel (Ni) barrier |
| Nickel/Gold (Ni/Au) | Tin (Sn), matte, with Nickel (Ni) barrier |
| Nickel/Gold (Ni/Au), electrolytic | Tin (Sn), matte, with Silver (Ag) barrier |
| Nickel/Gold (Ni/Au), ENIG | Tin (Sn), reflowed |
| Nickel/Palladium (Ni/Pd) | Tin (Sn), Semi-matte (Sn) |
| Nickel/Palladium/Gold (Ni/Pd/Au) | Tin/Bismuth (SnBi), <5% Bi |
| Nickel/Palladium/Gold (Ni/Pd/Au), ENEPIG | Tin/Bismuth (SnBi), =>5% Bi |
| Organic Solderability Preservative (OSP) | Tin/Bismuth/Gold (Sn/Bi/Au) |
| Organic Solderability Preservative (OSP-HT), high temp | Tin/Copper (Sn/Cu) |
| Palladium (Pd) | Tin/Copper (Sn/Cu), annealed |
| Platinum/Palladium/Silver (Pt/Pd/Ag) | Tin/Copper (Sn/Cu), HASL |
| Silver (Ag) | Tin/Copper (Sn/Cu), hot dipped |
| Silver (Ag), electroplated | Tin/Copper (Sn/Cu) matte |
| Silver (Ag), immersion | Tin/Lead (Sn63Pb37) |
| Silver (Ag), with Nickel (Ni) barrier | Tin/Lead (Sn90Pb05) |
| Silver/Palladium (Ag/Pd) | Tin/Lead/Silver (Sn/Pb/Ag) |
| Silver/Palladium (Ag/Pd), with Nickel (Ni) barrier | Tin/Silver (Sn/Ag) |
| Tin (Sn) | Tin/Silver (Sn/Ag), hot dipped |
| Tin (Sn), bright | Tin/Silver (Sn/Ag), plated |
| Tin (Sn), bright, annealed | Tin/Silver/Bismuth (Sn/Ag/Bi) |
| Tin (Sn), bright, fused | Tin/Silver/Bismuth/Copper (Sn/Ag/Bi/Cu) |
| Tin (Sn), bright, reflowed | Tin/Silver/Copper (Sn/Ag/Cu) |
| Tin (Sn), bright, reflowed over Nickel (Ni) barrier | Tin/Silver/Copper (Sn/Ag/Cu), hot dipped |
| Tin (Sn), bright, with Nickel (Ni) barrier | Tin/Zinc (Sn/Zn) |
| Tin (Sn), bright, with Silver (Ag) barrier | Tin/Zinc/Aluminum (Sn/Zn/Al) |
| Tin (Sn), hot dipped | Tin/Zinc/Nickel (Sn/Zn/Ni) |
| Tin (Sn), immersion | NAC* |
| Tin (Sn), matte | |

* “NAC” requires a notation in the manufacturing Information comment element

### 4.3.6 Bulk Solder Termination

If applicable, the bulk solder termination is the material of the Ball, or Column/Pillar Grid Array (BGA or CGA, ) shapes. The detailed requirements **shall** use the descriptions defined by the enumerations shown in Table 4-7. The bulk solder termination attribute is an XML enumeration string. Included will be the term “NAC” to indicate that none of the enumerations are appropriate and a comment is required as to the bulk solder termination material.

```
<xsd:attributename="bulkSolderTerminationArray"><xsd:simpleType>
    <xsd:restriction base="xsd:string">.
```

**Table 4-7 Bulk Solder Termination Enumerations**

| Code | Description |
|---|---|
| Sn03 | Tin/Lead(Sn3Pb97) |
| Sn05 | Tin/Lead(Sn5Pb95) |
| Sn10 | Tin/Lead (Sn10Pb90) |
| Sn60 | Tin/Lead (Sn60Pb40) |
| Sn62 | Tin/Lead/Silver (Sn62Ag2Pb36) |
| Sn63 | Tin/Lead (Sn63Pb37) |
| SAC101 | Tin/Silver/Copper (SAC101) |
| SAC105 | Tin/Silver/Copper (SAC105) |
| SAC125 | Tin/Silver/Copper (SAC125) |
| SAC255 | Tin/Silver/Copper (SAC255) |
| SAC305 | Tin/Silver/Copper (SAC305) |
| SAC310 | Tin/Silver/Copper (SAC310) |
| SAC405 | Tin/Silver/Copper (SAC405) |
| NAC | Not Applicable add comment as to alloy used |

```
<xsd:attributename="bulkSolderTermination">
  <xsd:simpleType>
<xsd:restriction base="xsd:string">
        <xsd:enumeration value="Sn03"/>
        <xsd:enumeration value="Sn05"/>
        <xsd:enumeration value="Sn10"/>
        <xsd:enumeration value="Sn60"/>
        <xsd:enumeration value="Sn62"/>
        <xsd:enumeration value="Sn63"/>
        <xsd:enumeration value="SAC101"/>
        <xsd:enumeration value="SAC105"/>
        <xsd:enumeration value="SAC125"/>
        <xsd:enumeration value="SAC255"/>
        <xsd:enumeration value="SAC305"/>
        <xsd:enumeration value="SAC310"/>
        <xsd:enumeration value="SAC405"/>
        <xsd:enumeration value="NAC"/>
   </xsd:restriction>
  </xsd:simpleType>
 </xsd:attribute>
```

Note: “NAC” requires a notation in the manufacturing Information comment element

## 4.4 J-STD-075 PSL Rating

The J-STD-075 PSL Rating is the process sensitivity level in accordance with J-STD-075. The PSL rating is a string but **shall** be based on the assembly processes for wave or reflow soldering as applicable. The rating for wave solder is indicated by W0 to W9; the indicators for reflow soldering are R0 to R9. In each identification the 0 signifies that the product is not sensitive to solder temperature while the 9 indicates that the product is below 240°C with no rating provided. See J-STD-075 for determining which number level is applicable to the subject product.

The details for the PSL rating are reported as an attribute of the Package description. See 4.1.5 through 4.1.11. Additional information if required is detailed in 4.4.1.

### 4.4.1 PSL Additional Information

The PSL Additional Information field allows for a more detailed description of limitations as stated in J-STD-020 or J-STD-075 that apply to the subject product. These limitations are called out by the third character in the PSL Rating. See Figure 4-5.

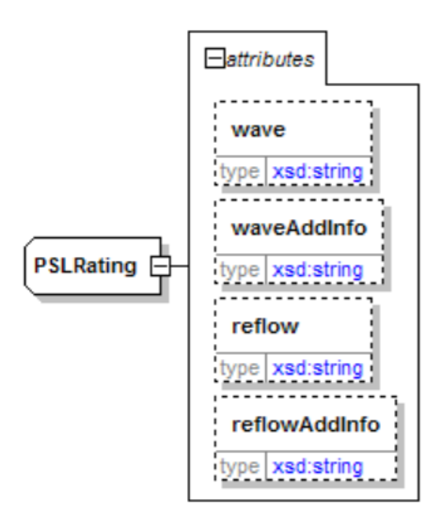



**Figure 4-5 PSL Rating Attributes**

### 4.4.2 PSL Third Character Enumerations

The third character **shall** be in accordance with Table 4-8 which shows the combination XML for Wave and reflow soldering. The enumerations shown in the table include the basic description and the add-on character for both wave and reflow sensitivity descriptions. If the third character is “Y”, the supplier should specifically state the additional limitation in the comment field.

**Table 4-8 PSL Character Combination with 3rd Character Definition**

| PSL 3rd Character | Definition |
|---|---|
| **(Blank)** | Component has no additional process limitations beyond the Classification Temperatures listed in 6.1.10 |
| **A** | Component has a Thermal Spike limitation |
| **C** | Component has a Preheat limitation. |
| **E** | Component has a Time in Wave limitation. |
| **F** | Component has a Time (tL) Above 217 °C liquidus temperature (TL) limitation. |
| **G** | Component has a Time Within 5 °C of $T_c$ limitation. |
| **H** | Component has a Ramp Down Rate limitation. |
| **J** | Component has a Number of Passes/Reflows limitation. |
| **K** | Component has a Flux limitation. |
| **M** | Component has a Cleaning limitation. |
| **N** | Component has limitations: C; F; G and J. |
| **P** | Component has limitations: C; F; G and H. |
| **R** | Component has limitations C; F and G. |
| **Y** | Component has additional limitations but the combination has not been assigned a code. Details of these unique limitations will need to be obtained from the Supplier. |
| **Z** | Not applicable No match for the package limitations – add comment to manufacturingInfo |

```
<xsd:attribute name="wave">
        <xsd:simpleType>
            <xsd:restriction base="xsd:string">
                <xsd:enumeration value="W0"/>
                <xsd:enumeration value="W1"/>
                <xsd:enumeration value="W2"/>
                <xsd:enumeration value="W3"/>
                <xsd:enumeration value="W4"/>
                <xsd:enumeration value="W5"/>
                <xsd:enumeration value="W6"/>
                <xsd:enumeration value="W7"/>
                <xsd:enumeration value="W8"/>
                <xsd:enumeration value="W9"/>
            </xsd:restriction>
        </xsd:simpleType>
    </xsd:attribute>
    <xsd:attribute name="waveAddInfo">
        <xsd:simpleType>
            <xsd:restriction base="xsd:string">
                <xsd:enumeration value="A"/>
                <xsd:enumeration value="C"/>
                <xsd:enumeration value="E"/>
                <xsd:enumeration value="F"/>
                <xsd:enumeration value="G"/>
                <xsd:enumeration value="H"/>
                <xsd:enumeration value="J"/>
                <xsd:enumeration value="K"/>
                <xsd:enumeration value="M"/>
                <xsd:enumeration value="N"/>
                <xsd:enumeration value="P"/>
                <xsd:enumeration value="R"/>
                <xsd:enumeration value="Y"/>
                <xsd:enumeration value="Z"/>
            </xsd:restriction>
        </xsd:simpleType>
    </xsd:attribute>
```

```
<xsd:attribute name="reflow">
        <xsd:simpleType>
            <xsd:restriction base="xsd:string">
<xsd:enumeration value="R0"/>
                <xsd:enumeration value="R1"/>
                <xsd:enumeration value="R2"/>
                <xsd:enumeration value="R3"/>
                <xsd:enumeration value="R4"/>
                <xsd:enumeration value="R5"/>
                <xsd:enumeration value="R6"/>
                <xsd:enumeration value="R7"/>
                <xsd:enumeration value="R8"/>
                <xsd:enumeration value="R9"/>
            </xsd:restriction>
        </xsd:simpleType>
    </xsd:attribute>
    <xsd:attribute name="reflowAddInfo">
        <xsd:simpleType>
            <xsd:restriction base="xsd:string">
                <xsd:enumeration value="A"/>
                <xsd:enumeration value="C"/>
                <xsd:enumeration value="E"/>
                <xsd:enumeration value="F"/>
                <xsd:enumeration value="G"/>
                <xsd:enumeration value="H"/>
                <xsd:enumeration value="J"/>
                <xsd:enumeration value="K"/>
                <xsd:enumeration value="M"/>
                <xsd:enumeration value="N"/>
                <xsd:enumeration value="P"/>
                <xsd:enumeration value="R"/>
                <xsd:enumeration value="Y"/>
                <xsd:enumeration value="Z"/>
            </xsd:restriction>
        </xsd:simpleType>
    </xsd:attribute>
```

### 4.5 Comments (Additional Manufacturing Process Information/Tin Whisker Mitigation)

The final field of the manufacturing process section provides an opportunity for the supplier to provide any additional manufacturability information, tin whisker mitigation techniques, or comments. The data type for comments is a string.

```
<xsd:attribute name="comment" type="xsd:string"/>
```

# Appendix A
# Manufacturing Field Data

## A1 Request for Information Section

| IPC Attribute | Mandatory | Description |
|---|---|---|
| Package Configuration | No | The package configuration **shall** meet the requirements of the naming convention and enumerations to be used as packageDesignators. The detail descriptions are according to those enumerations |
| J-STD-020 MSL Rating | No | The Moisture Sensitivity Level as defined in accordance with J-STD-020 indicating different levels of exposure and resistance to moisture penetration |
| J-STD-020 Classification Temperature ($T_C$) | No | The top dead center body temperature during reflow soldering to which the J-STD-020 MSL and the J-STD-075 PSL classifications apply that should not be exceeded during the surface mount assembly or other solder attach processes (including rework). |
| J-STD-020 Time Within 5°C of $T_C$ | No | The maximum time (in seconds) within 5°C of $T_C$ that should not be exceeded by the product in order to ensure assembly reliability. For Process Sensitive components see J-STD-075; this value may be different than that shown in J-STD-020. |
| Component Ramp Up Rate | No | The maximum change in the component body temperature over time (in °C/second) that should not be exceeded by the product in order to ensure assembly reliability. This maximum time may be different than that shown in J-STD-020. |
| Preheat Minimum Temperature | No | The minimum preheat temperature a process sensitive component can be subjected to other than the 150ºC value stated in the J-STD-020 classification profile and still insure the integrity and reliability of the product |
| Preheat Maximum Temperature | No | The maximum preheat temperature a process sensitive component can be subjected to other than the 200ºC value stated in the J-STD-020 classification profile and still insure the integrity and reliability of the product |
| Preheat Duration | No | The preheat duration a process sensitive component can be subjected to other than the 60-120 second value stated in the J-STD-020 classification profile and still insure the integrity and reliability of the product. |
| Component Temperature Spike | No | The maximum Component Temperature Spike is the maximum difference in temperature between the components' preheat exit temperature and its temperature upon contacting the solder wave in order to ensure the integrity and reliability of the product |
| Time Limitation Above 217 ºC | No | Time limitation above the liquidus temperature of 217ºC is the maximum time in seconds that the product can tolerate above the melting temperature of tin/lead solder. |
| Component Ramp Down Rate | No | Component Ramp down rate is the average cooling rate limitation for the component and is described in °C/second. |
| Maximum Number of Solder Processing Cycles | No | Maximum number of surface mount assembly or other solder attach processing cycles (including rework) to which the product can be subjected while ensuring assembly reliability at the peak process body temperature and maximum time at peak temperature. |
| Wave Solder Temperature (max.) | No | The maximum wave solder temperature that should not be exceeded during wave soldering assembly or other solder attach processes (including rework) in order to ensure the integrity and reliability of the product. |
| Total Time in Wave (max.) | No | The maximum time (in seconds) that through-hole component leads or SMT component bodies (submersion in solder) should not exceed in order to ensure the integrity and reliability of the product. |
| Terminal Shape | No | The terminal shape **shall** meet the requirements shown as the details for the enumerations in Table 4-4. The detail descriptions are according to those enumerations |
| Terminal Size | No | The terminal size is a string and indicates the minimum size and shape of the metallic land pattern for proper attachment of the package to the mounting substrate |

| IPC Attribute | Mandatory | Description |
|---|---|---|
| Number of Terminal Instances | No | The number of terminals is defined as an integer and includes all terminations of the product, whether used or not, including those that may be required for electrical, mechanical or thermal attachment. |
| Terminal Base Alloy | No | The base material of the lead or lead frame. |
| Terminal Plating | No | The terminal plating is the uppermost homogeneous material in the termination used on the item to make an electrical connection, sometimes referred to as ‘Second Level Interconnect. |
| Bulk Solder Termination | No | The bulk solder termination is the material of the Ball, Column/Pillar Grid Array (BGA or CGA) shapes. |
| J-STD-075 PSL Rating | No | The J-STD-075 PSL Rating is the process sensitivity level in accordance with J-STD-075 |
| PSL Additional Information | No | The PSL additional information field allows for a more detailed description of limitations as stated in J-STD-020 or J-STD-075 that apply to the subject product. These limitations are called out by a 3rd character in the PSL Rating. |
| Comments (Additional Manufacturing Process Information /Tin Whisker Mitigation) | No | Any additional manufacturability information or comments pertaining to the item |

# Appendix B
## Examples of PSL Conditions

| Commodity | Preheat Temperature (Max. Time) | Time (tL) Above 217 °C Liquidus Temperature (TL) (Note 1) | Classification Temperature (Tc) | Time (tp) Within 5°C of Tc | Ramp-down Rate (Note 2) | # of Reflows | Fluxes | Cleaning | PSL/ Notes |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum Capacitors ≤6.3 mm Dia. and height ≤4.5 mm | Min = 100°C Max = 150°C (90 s.) | 30 s. max. | 240°C | 5 s. max. | – | 2 | – | – | R8N |
| Aluminum Capacitors ≤6.3mm Dia. and height >4.5 mm | Min = 100°C Max = 150°C (90 s.) | 30 s. max. | 250°C | 5 s. max. | – | 2 | – | – | R6N |
| Aluminum Capacitors >6.3 mm Dia. and ≤10 mm Dia. | Min = 100°C Max = 150°C (90 s.) | 20 s. max. | 240°C | 5 s. max. | – | 2 | – | – | R8N |
| Aluminum Capacitors >10 mm Dia. | Min = 100°C Max = 150°C (120 s.) | 20 s. max. | 230°C | 5 s. max. | – | 2 | – | – | R9N |
| Plastic Molded Polymer Aluminum Capacitors with heights ≥1.8 mm and voltage rating <12.5Volts | Max = 180°C (120 s.) | 60 s. max. | 250°C | 5 s. max. | – | 2 | – | – | R6N |
| Plastic Molded Polymer Aluminum Capacitors with heights ≥1.8 mm and voltage ratings ≥12.5volts | Max = 180°C (120 s.) | 30 s. max. above 200°C | 240°C | 5 s. max. | – | 1 | – | – | R8N |
| Plastic Molded Polymer Aluminum Capacitors with heights ≤1.1 mm | Max = 180°C (120 s.) | 30 s. max. above 200°C | 240°C | 5 s. max. | – | 2 | – | – | R8N |
| Can Type Polymer Aluminum Capacitors | Min = 100°C Max = 150°C (120 s.) | 40 s. max. | 250°C | 5 s. max. | – | 2 | – | – | R6N |
| Film Capacitors: Polyphenylene Sulfide (PPS) | Max = 180°C (120 s.) | 30 s. max. | 260°C | 5 s. max. | – | 2 | – | – | R4N |
| Film Capacitors: Non-PPS Type | Max = 180°C (120 s.) | 30 s. max. | 240°C | 5 s. max. | – | 2 | – | – | R8N |
| Plastic Molded Polymer Tantalum Capacitors with voltage ratings ≤10 Volts | Max = 180°C (120 s.) | 40 s. max. | 250°C | 5 s. max. | – | 2 | – | – | R6N |
| Plastic Molded Polymer Tantalum Capacitors with voltage ratings >10 Volts | Max = 180°C (120 s.) | 30 s. max. | 250°C | 5 s. max. | – | 2 | – | – | R6N |
| Can/coin Type Electric Double Layer Carbon - Special Capacitors | Min = 100°C Max = 150°C (120 s.) | 30 s. max. above 200°C | 235°C | 5 s. max. | – | 2 | – | – | R9N |
| Crystals; Oscillators; Resonators | Time (Tsmin to Tsmax) (ts) = 120 s. max. | 90 s. max. | 250°C | 10 s. max. | 5°C/s. max. | – | – | – | R6R |
| Fuses | (85 s.) | 65 s. max. | Note 4 | 20 s. max. | 5°C/s. max. | – | – | – | R_P Note 3 |
| Inductors and transformers with insulated wire type coils | Min = 100°C Max = 150°C (90 s.) | 60 s. max. | Note 4 | 20 s. max. | 5°C/s. max. | – | – | – | R_R Note 3 |
| Non-Solid state Relays | Note 5 | Note 5 | 250°C | Note 5 | Note 5 | Note 5 | – | – | R6_ Note 3 |
| LEDs | Note 5 | Note 5 | Notes 4 and 5 | Note 5 | Note 5 | Note 5 | – | – | R__ Note 3 |
| SMT Connectors for through hole reflow | See Supplier specific component reflow information and recommendations. PSL classification to this specification is required. | | | | | | | | |

( – ) = No Exception Specified

Note 1: It may be very difficult to establish a soldering profile for a given assembly for components with $t_L$ <50 s.

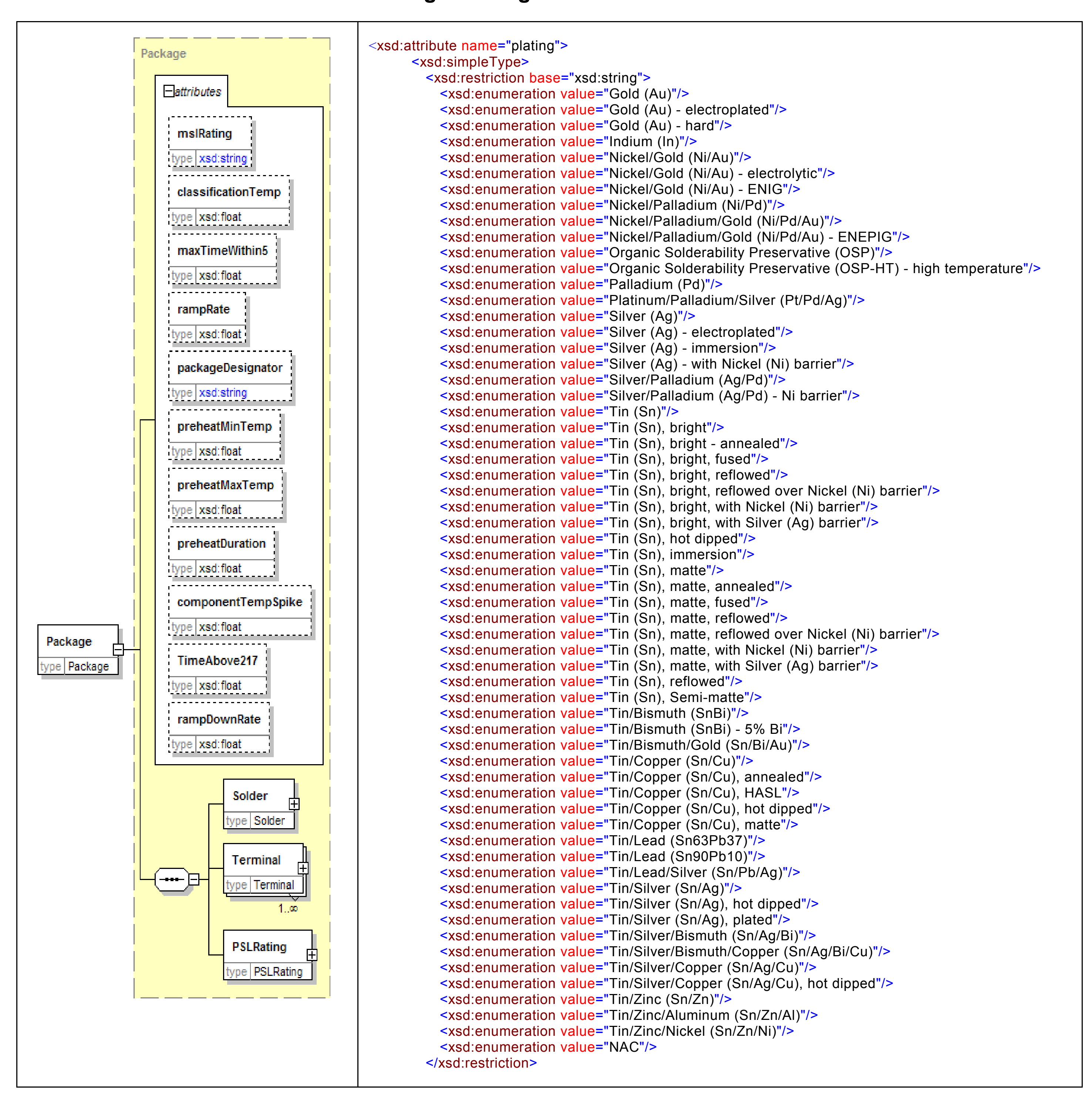
Note 2: Ramp Down Rate is the average cooling rate in ° C/s.

Note 3: The underscore "_" denotes that the omitted character **shall** be defined by the Supplier.

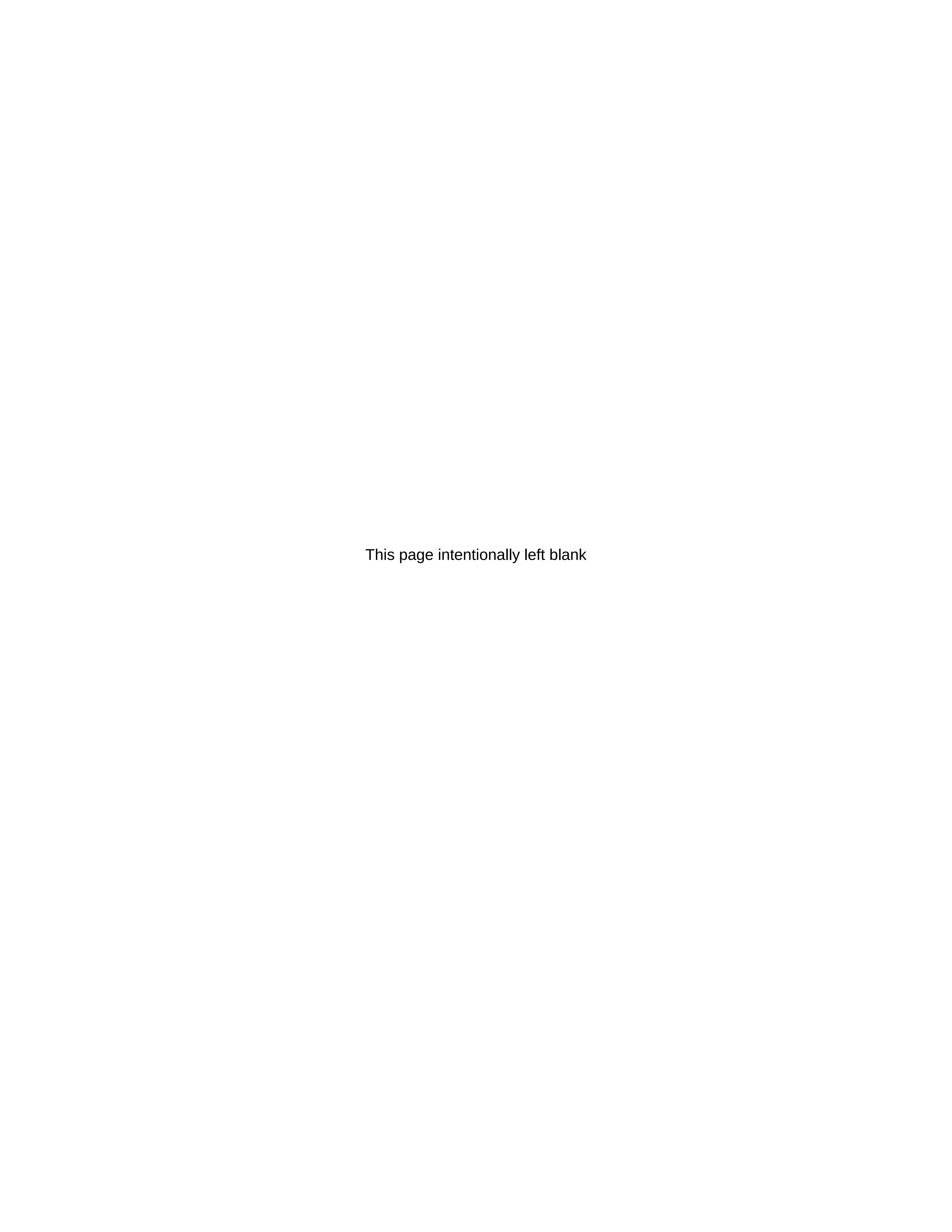
Note 4: Classification Temp ($T_c$), the PSL's 2nd character, is based upon package thickness (height) and volume per J-STD-020 Table 4-1. A lower Classification Temp ($T_c$) may be used by Suppliers, if their component cannot meet the base solder process condition.

Note 5: There is industry consensus that this component is process sensitive. However, the supported soldering profile conditions vary widely by Supplier. The Supplier **shall** be contacted for recommended solder process conditions.

# Appendix C
# Package Plating XML Schema




```
<xsd:attribute name="plating">
        <xsd:simpleType>
          <xsd:restriction base="xsd:string">
            <xsd:enumeration value="Gold (Au)"/>
            <xsd:enumeration value="Gold (Au) - electroplated"/>
            <xsd:enumeration value="Gold (Au) - hard"/>
            <xsd:enumeration value="Indium (In)"/>
            <xsd:enumeration value="Nickel/Gold (Ni/Au)"/>
            <xsd:enumeration value="Nickel/Gold (Ni/Au) - electrolytic"/>
            <xsd:enumeration value="Nickel/Gold (Ni/Au) - ENIG"/>
            <xsd:enumeration value="Nickel/Palladium (Ni/Pd)"/>
            <xsd:enumeration value="Nickel/Palladium/Gold (Ni/Pd/Au)"/>
            <xsd:enumeration value="Nickel/Palladium/Gold (Ni/Pd/Au) - ENEPIG"/>
            <xsd:enumeration value="Organic Solderability Preservative (OSP)"/>
            <xsd:enumeration value="Organic Solderability Preservative (OSP-HT) - high temperature"/>
            <xsd:enumeration value="Palladium (Pd)"/>
            <xsd:enumeration value="Platinum/Palladium/Silver (Pt/Pd/Ag)"/>
            <xsd:enumeration value="Silver (Ag)"/>
            <xsd:enumeration value="Silver (Ag) - electroplated"/>
            <xsd:enumeration value="Silver (Ag) - immersion"/>
            <xsd:enumeration value="Silver (Ag) - with Nickel (Ni) barrier"/>
            <xsd:enumeration value="Silver/Palladium (Ag/Pd)"/>
            <xsd:enumeration value="Silver/Palladium (Ag/Pd) - Ni barrier"/>
            <xsd:enumeration value="Tin (Sn)"/>
            <xsd:enumeration value="Tin (Sn), bright"/>
            <xsd:enumeration value="Tin (Sn), bright - annealed"/>
            <xsd:enumeration value="Tin (Sn), bright, fused"/>
            <xsd:enumeration value="Tin (Sn), bright, reflowed"/>
            <xsd:enumeration value="Tin (Sn), bright, reflowed over Nickel (Ni) barrier"/>
            <xsd:enumeration value="Tin (Sn), bright, with Nickel (Ni) barrier"/>
            <xsd:enumeration value="Tin (Sn), bright, with Silver (Ag) barrier"/>
            <xsd:enumeration value="Tin (Sn), hot dipped"/>
            <xsd:enumeration value="Tin (Sn), immersion"/>
            <xsd:enumeration value="Tin (Sn), matte"/>
            <xsd:enumeration value="Tin (Sn), matte, annealed"/>
            <xsd:enumeration value="Tin (Sn), matte, fused"/>
            <xsd:enumeration value="Tin (Sn), matte, reflowed"/>
            <xsd:enumeration value="Tin (Sn), matte, reflowed over Nickel (Ni) barrier"/>
            <xsd:enumeration value="Tin (Sn), matte, with Nickel (Ni) barrier"/>
            <xsd:enumeration value="Tin (Sn), matte, with Silver (Ag) barrier"/>
            <xsd:enumeration value="Tin (Sn), reflowed"/>
            <xsd:enumeration value="Tin (Sn), Semi-matte"/>
            <xsd:enumeration value="Tin/Bismuth (SnBi)"/>
            <xsd:enumeration value="Tin/Bismuth (SnBi) - 5% Bi"/>
            <xsd:enumeration value="Tin/Bismuth/Gold (Sn/Bi/Au)"/>
            <xsd:enumeration value="Tin/Copper (Sn/Cu)"/>
            <xsd:enumeration value="Tin/Copper (Sn/Cu), annealed"/>
            <xsd:enumeration value="Tin/Copper (Sn/Cu), HASL"/>
            <xsd:enumeration value="Tin/Copper (Sn/Cu), hot dipped"/>
            <xsd:enumeration value="Tin/Copper (Sn/Cu), matte"/>
            <xsd:enumeration value="Tin/Lead (Sn63Pb37)"/>
            <xsd:enumeration value="Tin/Lead (Sn90Pb10)"/>
            <xsd:enumeration value="Tin/Lead/Silver (Sn/Pb/Ag)"/>
            <xsd:enumeration value="Tin/Silver (Sn/Ag)"/>
            <xsd:enumeration value="Tin/Silver (Sn/Ag), hot dipped"/>
            <xsd:enumeration value="Tin/Silver (Sn/Ag), plated"/>
            <xsd:enumeration value="Tin/Silver/Bismuth (Sn/Ag/Bi)"/>
            <xsd:enumeration value="Tin/Silver/Bismuth/Copper (Sn/Ag/Bi/Cu)"/>
            <xsd:enumeration value="Tin/Silver/Copper (Sn/Ag/Cu)"/>
            <xsd:enumeration value="Tin/Silver/Copper (Sn/Ag/Cu), hot dipped"/>
            <xsd:enumeration value="Tin/Zinc (Sn/Zn)"/>
            <xsd:enumeration value="Tin/Zinc/Aluminum (Sn/Zn/Al)"/>
            <xsd:enumeration value="Tin/Zinc/Nickel (Sn/Zn/Ni)"/>
            <xsd:enumeration value="NAC"/>
          </xsd:restriction>
```



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# Standard Improvement Form

**IPC-1756**

The purpose of this form is to provide the Technical Committee of IPC with input from the industry regarding usage of the subject standard.

Individuals or companies are invited to submit comments to IPC. All comments will be collected and dispersed to the appropriate committee(s).

If you can provide input, please complete this form and return to:

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E-mail: answers@ipc.org

1. I recommend changes to the following:

___ Requirement, paragraph number __________

___ Test Method number __________, paragraph number __________

The referenced paragraph number has proven to be:

___ Unclear ___ Too Rigid ___ In Error

___ Other ______________________________

2. Recommendations for correction:

______________________________

______________________________

______________________________

______________________________

3. Other suggestions for document improvement:

______________________________

______________________________

______________________________

______________________________

Submitted by:

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Company ______________________________ E-mail ______________________________

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